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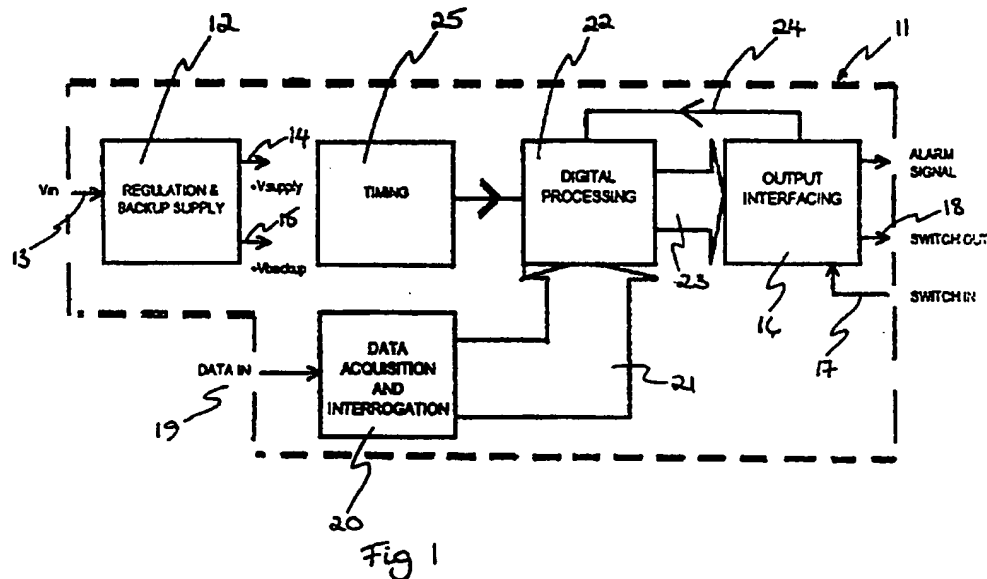
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(54) Abstract Title  
Rental equipment timer control system

(57) Rental equipment has built in a timer control unit 11 having a digital processing unit 22 controlling a switch unit 16 controlling power in and out lines 17, 18. The unit has a data port 19 through which a representative of the hiring company can input/reset the timer unit via a data acquisition and interrogation unit 20. Operating and back-up power 12 for the unit is preferably taken from a low power bus of the rental equipment. Preferably, the unit is made from solid state components on a single circuit card. A circuit diagram is provided (Fig 2). The equipment is preferably a television or video recorder.



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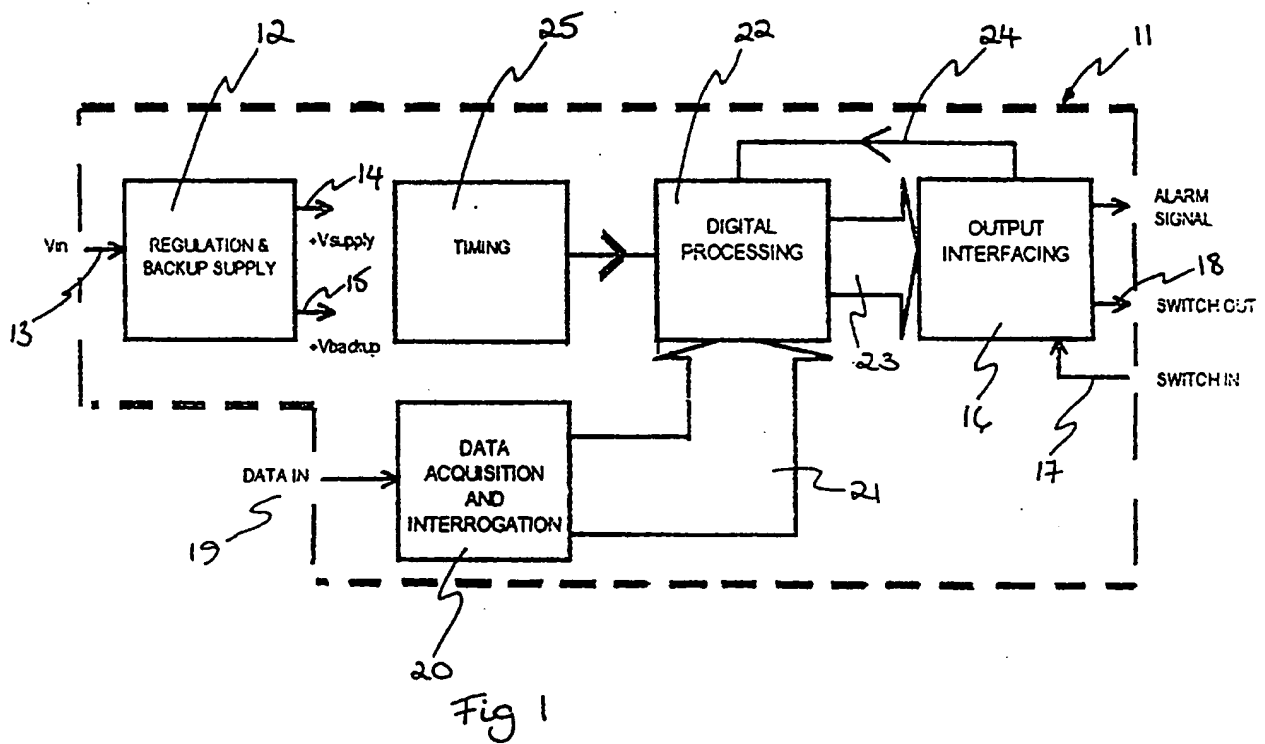
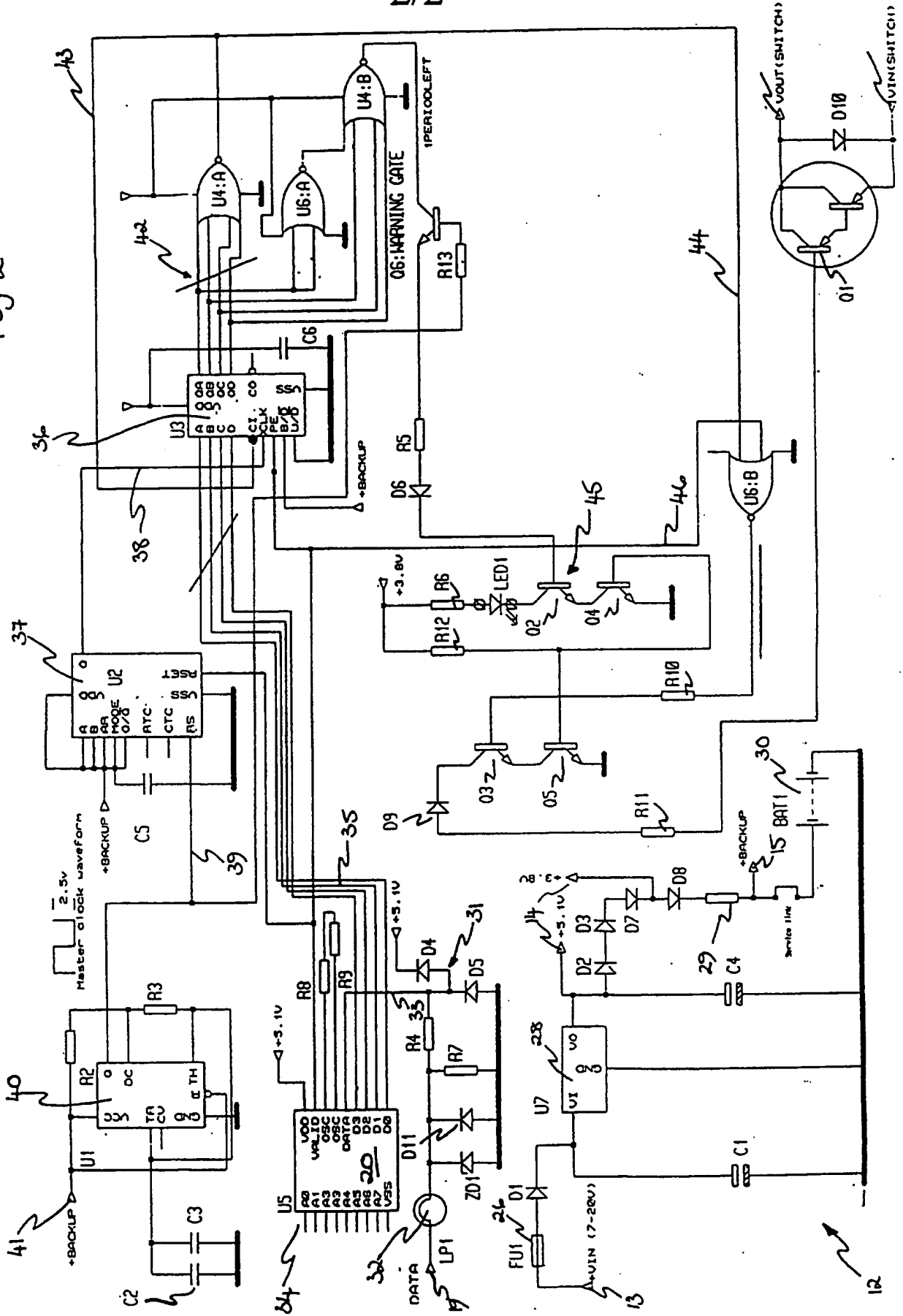


Fig 2



## IMPROVED MONITORING APPARATUS

The present invention relates generally to monitoring apparatus, and particularly to monitoring apparatus for  
5 supervising the operation of electrical equipment. The need to supervise the operation of electrical equipment arises in a number of different circumstances where the supervision may be required for security purposes or merely for data acquisition on the use made of the  
10 equipment or the functionality of the equipment or its performance.

The present invention finds particular utility in connection with the monitoring of electrical equipment  
15 hired to a user and will be described in more detail hereinafter with particular reference to this application without prejudice to the generality of the invention.

When electrical equipment is rented to a user the rental  
20 agreement may provide simply for periodic rental payments to be made for the availability of the equipment, or it may provide for rental payments to be dependent on the amount of use made of the equipment.

25 These two situations will be distinguished hereinafter by reference to a rental agreement and "rented" equipment in

case of an agreement simply making the equipment available for the rental period, and a "hire" agreement in connection with one in which the customer is charged on the basis of the amount of use made of the equipment.

5 Various problems arise with rented and hired electrical equipment. Although the vast majority of people honour their rental and hire agreements and make payments regularly, it is known that disagreements arise from time to time, and it is difficult to re-gain possession of  
10 electrical equipment when faced with an uncooperative or even recalcitrant customer.

Although it is possible to have recourse to the courts for a possession order, cost of such action is often out  
15 of proportion to the value of the goods to be recovered. Moreover, a company renting or hiring out electrical equipment would prefer to encourage customers to make the necessary payments in accordance with the rented or hire agreement rather than simply to recover the equipment as  
20 a continuing rental or hire agreement may be more valuable over time than the short term recovery of equipment.

When dealing with customers on a low budget it is prudent  
25 for a business to allow only limited credit since the customer may very easily exceed the constraints imposed

by their own limited resources and end up with a debt which they are unable to meet. A responsible rented or hire company will wish to avoid this situation developing as a result of their commercial activities not only from  
5 the point of view of their own business, but also from a responsible social position.

Traditionally electrical equipment rented to customers is paid for on a periodic basis by rental payments which may  
10 fall due every week, every month or every quarter. It is unusual for electrical equipment to be rented on the basis of annual payments. Part of the reason for the frequency of the rental payments is to enable the equipment company to have regular access to check the  
15 rented equipment is not being abused, but also to limit the amount of credit given at any one time.

In circumstances where the credit risk is high the prior art solution is to hire equipment and provide a pre-  
20 payment meter which operates a switch in the electricity supply line thereby, effectively, controlling the amount of time for which the equipment can be used. Pre-payment meters may be coin or token operated. In the latter case the customer purchases a number of tokens from the hiring  
25 company as the means of obtaining a "block" of time for use of the equipment.

Such control systems have a number of disadvantages. First, because they collect coins or tokens, they take up a significant amount of space and therefore must be mounted outside the casing of the electrical equipment, usually in a separate housing connected in the electrical supply line from the mains outlet to the equipment. However, because of the exposed position of the timing equipment unscrupulous customers may seek to bypass the control and timing equipment by connecting wires to the electrical supply line shunting out the control unit, or even by cutting off the control unit and re-fitting a plug to the cable thus exposed. Alternatively, by forcing open the casing of the monitoring equipment it is possible to gain access to the coin or token container, allowing the recycling of one coin through the mechanism. The coin container itself is, moreover, a security risk as it constitutes a known location of a collection of money and is therefore a target for burglars. Furthermore, if the electrical equipment is stolen it can be rendered usable very easily by cutting off the monitoring equipment and there is nothing to indicate that the equipment has been stolen.

All of these problems arise largely because the equipment is out of the control of the hiring company once it has been placed in the customer's premises and access to it

can be denied by the customer being uncooperative or even absent from the premises when the representative of the hiring company calls.

5 There is, therefore, a need for monitoring equipment for providing an available use period or an availability period which is incorruptible, preferably mounted within the casing of the electrical equipment itself, and which does not require coins or tokens to determine a time  
10 period of operation. In the specific field of application referred to above, it is required to be able to disable the monitored electrical equipment when a credit period has expired thereby ensuring that the customer, if wanting to make further use of the  
15 equipment, will voluntarily make contact with the hiring company to arrange for a new credit period to be made available. The monitoring equipment must, therefore, be small enough to be housed within the casing of the monitored electrical equipment in order to inhibit the  
20 possibility of it being bypassed and, preferably, should have means for providing an external display indicating if an attempt has been made to corrupt or tamper with the time period set thereby (such display may be provided in a confidential manner, that is it may be perceptible to  
25 a representative of the hiring company without being perceptible to the customer) and it has to be possible to



re-set a time period quickly and easily without using tokens or coins, and without requiring to remove the monitoring equipment from the monitored equipment.

5 According to one aspect of the present invention, therefore, there is provided monitoring apparatus for providing a control output on a secure output line a given time period after a secure input of data identifying the said certain time period.

10

In this context it will be understood that the term "secure" will be taken to mean a communication line which is not accessible to an average user, and will not imply the level of security required against persistent or  
15 organised fraud or theft.

According to another aspect, monitoring apparatus includes a timing device having a data input, memory means storing a security code and means for determining  
20 a time interval in response to a coded data input including the said security code, and operable at the end of the said time period determined by the input data code to provide an output signal representing termination of the said determined time period.

25

By making the time period dependent on the input of a

security code it is possible for the equipment to be operated to provide different time periods but to do so only when set by an authorised user such as a representative of a hire company able to provide the  
5 secure input required by the equipment. The security code may, for example, include a unique reference code identifying the monitoring apparatus itself, and recognised thereby, and such code may not be a unique code, but a code changed each time the apparatus is used,  
10 or in accordance with other factors or algorithms so that it is not possible externally to predict the code and consequently corrupt the equipment.

In a first embodiment of the invention there are further  
15 provided means for recording the said determined time interval. Such means for recording the said determined time interval may act to record the said interval separately from (that is outside) the memory of the timing device itself.

20

There may be further provided means for providing an advance warning of the end of the said determined time interval. This warning means may comprise a visual and/or an acoustic indicator. In response to such  
25 warning a user has an opportunity to contact the hiring company to make payment for a further period of use of

the hired equipment before the end of the period for which payment has already been made.

In the specific application given above as a non-  
5 limitative example, the monitoring apparatus preferably acts at the end of the said determined time interval to make the monitored electrical equipment effectively unusable. For this purpose the said output signal may control the functioning of a particular circuit block  
10 such as a signal processing or basic processing stage which is vital to the current operation of the monitored electrical equipment the availability for use of which is controlled by the said timing device. Such unit block may be the luminance or chrominance processing stage. By  
15 covering one of these stages the RGB video levels would be reduced thereby causing the CRT gun to cut off and blanking the screen. Thus, without affecting the power supply to the monitored electrical apparatus as a whole (which might provoke attempts to circumvent the  
20 monitoring equipment) the monitored apparatus can be rendered unavailable to the user.

The said coded data input to the timing device may be effected via a data port having means for protecting the  
25 said memory means from voltage overloads. This avoids the risk of inadvertent connection of the data input port

to the power supply as well as protecting the system from a deliberate attempt to disable it by application of mains voltage to the data port by an unscrupulous user. As mentioned above, it is a particular feature of the  
5 present invention that the monitoring equipment is difficult to circumvent either by unscrupulous customers of the hiring company or by thieves after having stolen the equipment, thereby making the equipment unattractive to such people.

10

In a preferred embodiment of the invention the said data port is a serial data port and the overload protection means includes a Zener diode the anode of which is connected to ground. The overload protection means also  
15 includes an incandescent bulb which acts to dissipate the surplus energy of an excess voltage as heat. This enables the apparatus of the invention to survive direct connection of the data port to the mains without affecting its subsequent performance.

20

The apparatus of the present invention may, in a simple embodiment, act to provide a single determined time period when activated so that its operation shall be as simple and incontestable as possible. In the exemplary  
25 application described above, therefore, if the time period is a week or a month both the customer and the

hiring company have certainty of the period of availability of the monitored hired equipment after activation of the monitoring equipment housed therein. In other circumstances there may be provided means for  
5 selection of the said determined time period and for communicating the said selected time period to the memory means in association with the said security code whereby to initiate and validate a timing operation.

10 Because electrical timing equipment relies on the continuity of power supply in order to operate an unscrupulous customer may seek to disconnect the monitored electrical equipment from the mains power for certain periods within the said determined time period in  
15 order to extend this latter and the apparatus of the present invention may therefore, be further provided with battery backup means for maintaining the circuits of the device operative in the absence of the main power supply. This will also ensure, from the customers point of view,  
20 that an interruption in the mains power supply will not affect the hire period.

In such apparatus there may also be provided means for detecting the occurrence of an attempt to corrupt the  
25 data in the memory means and/or to bypass the timing device, such means preferably being operable to provide

a confidential output indicating such attempts. The representative of the hire company may then take appropriate action at the commencement of the next hire period either by issuing a warning or by withdrawing the  
5 equipment on the grounds that it is at risk of further tampering.

The present invention also comprehends a system for monitoring and/or controlling the operation of monitored  
10 electrical apparatus comprising a timing device as described hereinabove and an associated, but separate, data input device having means for storing and transferring a validation code recognised by the timing device itself, and means for reading data stored in the  
15 memory of the timing device as well as means for issuing a reset command to initiate a fresh determined time interval.

The data input device may have a plug connector for  
20 selective connection to a serial data port of the timing device.

The said data input device may also incorporate means for interrogating the memory means of the timing device to  
25 look for evidence of any operating violation before issuing a validation code and/or a timer reset signal.

Such a system may have the data input device permanently connected to the timing device and provided with selectively operable data input means such as a keypad.

5 The present invention also comprehends a method of controlling the operation of monitored electrical apparatus comprising the steps of:

- providing the apparatus with a timing device operable to define a determined time period:

10 - initiating commencement of a said determined time period:

- recording the length of the said determined time period and the instant of commencement thereof separately from the monitored electrical apparatus:

15 - monitoring the said determined time period remotely from the electrical apparatus: and

- before or after the end of the said determined time period comparing the separately recorded time interval with that recorded by the timing device and

20 initiating a further said determined timing interval if there is no evidence of corruption or attempted corruption of the operation of the said timing device.

Embodiments of the present invention will now be more particularly described, by way of example, with reference  
25 to the accompanying drawings in which:

Figure 1 is a block schematic diagram of the major components of monitoring apparatus formed in accordance with the principles of the present invention; and

Figure 2 is a schematic circuit diagram illustrating  
5 a part of the apparatus of the invention shown in Figure 1 in more detail.

Figure 1 illustrates the major components of a first embodiment of the present invention adapted to monitor  
10 the operation of electrical equipment such as a television or video recorder intended to be hired out for domestic use. The monitoring apparatus, generally indicated by 11 housed within the broken outline boundary, comprises a voltage regulator and back-up  
15 supply unit 12 which receives its supply voltage at an input 13 and has two outputs, a first output 14 delivering the regulated voltage derived from the supply voltage applied at input 13, and a back-up voltage 15 derived from an internal battery (not shown) which may be  
20 a rechargeable battery. The input 13 may be connected to one of the 7-20 volt rails usually present within the type of electrical equipment for which the monitoring apparatus of the present invention is primarily intended. In this way the electrical power supply for the  
25 monitoring apparatus is derived internally of the controlled electrical apparatus and does not need an



external power supply unlike prior art devices.

In Figure 1 the outputs 14, 15 are shown exiting the voltage regulator and back-up supply unit 12 but not  
5 connected to any individual unit within the system 11 since, in fact, these supply outputs are separately connected to all of the units within the system.

The monitoring equipment 11 is made of solid-state  
10 components mounted preferably on a single printed circuit board of dimensions sufficiently small to allow it to be fitted within a television cabinet without affecting the performance of the television. The monitoring equipment 11 is connected to the television's power supply at a  
15 point isolated from the mains supply in order to avoid the risk of electric shock at a data input socket 19 which will be described in more detail below. Electrical equipment for which the monitoring apparatus of the present invention is intended would usually have a low  
20 voltage rail, usually of the isolated switch mode type, with a chopper transformer for mains isolation. If no mains isolation is available special circuit arrangements (not shown) would have to be made and includes an output interfacing unit 16 including a switching unit which  
25 controls the continuity of a connection between an input 17 and an output 18 connected into one of the

television's essential operating circuits. As discussed above this may be one of the signal processing circuits which result in the screen going blank if they fail to function. These connections to the signal processing circuit are made within the television cabinet itself and are therefore relatively incorruptible in that they cannot easily be found or bypassed by the average user. A skilled person may be able to locate the monitoring control circuit within the television cabinet and to bypass it, for example by soldering a wire across the terminals of the switching unit, that is between the input line 17 and the output 18 of the output interfacing unit 16. However, such corruption can be detected either by evidence that the television cabinet has been opened (for which purpose the fixing screws may be provided with appropriate seals) or there may be provided internal arrangements for detecting such tampering as will be described in more detail below.

The monitoring equipment 11 housed within the television casing requires means for communicating with an authorised representative of the hiring company, and this is achieved via a data port 19 which is fitted to the television cabinet and represents the only visible modification of the television required to make it suitable for this purpose. The data port may, of course,

be fitted to the rear panel which already has the aerial and power supply sockets, and after also a SCART socket, and accordingly the presence of another socket is not detrimental. The data port 19 leads to a data acquisition and interrogation unit 20 which is connected by a data bus 21 to a digital processing unit 22 itself linked by a data bus 23 to the output interfacing unit 16. The digital processing unit 22 includes memory means for storing data concerning the operation of the system. A feedback line 24 is provided for instructing digital processing block 22 that a current timed period has ended so that it can cease counting and can reset its registers. It acts as a positive feedback in the sense that it maintains a latched "off" state for the output interfacing block 16.

The main function of the monitoring apparatus 11 is to provide a regulated determined time period of availability of the equipment during which the output interfacing unit 16 maintains continuity between the power input line 17 and the output 18, and this is achieved by a timing unit 25 which acts to provide block signals for control of the digital processing circuit 22. It should be appreciated that the timing unit 25 is not a clock as such in that it does not provide for precise time keeping. Typically, a hire period may be one week,

two weeks or a month and accuracy of time keeping need be only to the nearest hour or even several hours over such a period. In this sense the time keeping accuracy is extremely coarse. It is also important to appreciate  
5 that the monitoring equipment 11 is intended to enable a representative of the hiring company to provide or deprive a customer of credit by setting the digital processing unit 22 to recognise the termination of a determined time interval and thereafter to switch off the  
10 connection between the terminals 17, 18 whereby to disable the monitored electrical apparatus (the television in the example given above) for which purpose the hire company's representative is provided with a "commander" unit (not shown) which remains in the  
15 possession of the representative and has a connector plug for insertion into the socket 19. The commander unit is programmed or programmable with a security code recognised by the data acquisition and interrogation circuit 20 to allow communication to the digital  
20 processing unit 22 with a signal representing a determined time interval stored in the memories of the digital processing circuit 22 once operation is initiated. The security code is unique to a particular item of monitored apparatus and used by the monitoring  
25 unit 11 to verify the validity of incoming data arriving at the socket 19 whereby to protect against attempts to

corrupt the equipment by applying signals to the socket 19. The commander unit also obtains the required time period of operation of the monitored apparatus from input by the authorised representative of the hire company.

5 This is specified as multiples of weeks from 0 (that is shutdown mode in which the unit is ready for delivery or collection) to a maximum of 15. Of course these values may be different in other embodiments.

10 Figure 2 illustrates the monitoring equipment 11 of Figure 1 in more detail. The power supply terminal 13 leads via a fusible link 26 and a diode 27 to the voltage regulation and backup unit generally indicated 12 including an IC voltage regulator 28 which provides a  
15 regulated +5v output from the input voltage which may be a 7V-20v DC supply derived from the monitored apparatus as described above. This provides two regulated low voltage outputs 14 which, in this example, comprise one at 5.1 volts and one at 3.8 volts the latter being taken  
20 from a voltage dropping diode array comprising diodes D2, D3 and D7 which are used as low loss voltage dropping components to provide the 3.8v rail from the 5.1v rail. The cathode of diode D7 is also connected via diode D8 and a resistor 29 to a battery 30. Diode D8 is used to  
25 reduce the 3.8v rail further to a voltage which is suitable to maintain the charge on battery 30. It also

acts to prevent the battery 30 from discharging through the circuit loads connected to the 3.8v and 5.1v rails when (or if) the monitored apparatus is switched off and these rails consequently collapse. The 5.1 volt output  
5 is connected to supply the data acquisition and interrogation unit 20 which comprises a serial decoder recording the validation code which is applied at one input (identified by the legend "data" from the data input socket 19 via an overload protection circuit  
10 generally indicated 31 comprising an incandescent bulb 32 grounded by a Zener diode ZD1 connected in parallel to ground by a diode D11 and a resistor R7 and biased from the +5.1 volt output of the voltage regulator and back-up supply unit via diodes D4 D5 and a resistor R4. If an  
15 attempt is made to corrupt or damage the unit by connection of a voltage source, such as the mains voltage to the data input socket 19 the excess power is harmlessly dissipated as heat by the filament of the incandescent bulb 32. This reduces the current flowing  
20 in the circuit to a safe level and even if mains voltage is applied the unit can immediately afterwards accept data from an authorised input without damage or corruption. Further protection is provided by the faster catching diodes D4/D5, which together with R4, limit the  
25 data input voltages to the data acquisition and interrogation circuit 20, to +5.8 and -0.6v. Any excess

is dissipated in resistor R4. The resistor R7 improves circuit immunity from corrupt data caused by line time base radiation, background noise, etc, and also provides a terminating impedance for the data from the authorised  
5 collection staff's commander unit.

The data input on the data input port 19 is then fed via a data line 33 to a "data" input of the security recognition and serial decoder 20 which includes an  
10 integrated circuit having a memory for storing the validation code set upon production of the unit by appropriately energising the decoder input lines generally indicated 34. The data input port 19 may also receive a coded signal representing the desired time  
15 period to be set by the equipment, and the serial decoder 20 acts, assuming an appropriate validation code has also been received to provide output signals on lines 35 to a counter unit 36 in the form of a parallel shift register which receives timing input signals on a clock input CLK  
20 from a timer unit 37 (essentially a divider circuit) on a line 38. The divider circuit 37 receives a clock input at 0.1 Hz on line 39 from a master oscillator 40 the input 41 to which is supplied from the backup output 15 from the battery 30 by feeding the master oscillator. In  
25 this way (bearing in mind that the terminal 15 from the backup battery 30 also receives current via resistor R1

and diode D2, D3, D7 and D8) the power supply to the master oscillator 40 is uninterruptible so that in the event that the equipment is disconnected from the mains supply, or if the mains supply fails, the timing function continues. The backup supply is also applied to the programmable counter 36 and to gates 43, 44 and 46 so that the functions of the unit performed by these components is also uninterruptible.

10 The divider 37 acts to divide down the 0.1 Hz signal arriving on line 39 to a signal at one pulse per week from the output Q from the divider 37 which, as mentioned before, leads on line 38 to the clock input CLK of the counter 36. The output from the counter 36 is delivered  
15 on an elapsed time bus 42 to a binary-to-decimal converter circuit comprising three gates U4A, U4B and U6A. The output from gate U4A is fed back to the CI input of the counter on line 43 and also to one input of a further gate U6B on line 44. This signal is issued at  
20 the end of the timing period and acts to stop the counter 36 and to provide the output signal from the circuit to turn off the power switch as will be described in more detail below.

25 The output from gate U4A is issued after N input pulses have arrived at the counter 36 on line 38. "N"



represents the decimal value of the binary signals present on the A-D inputs programmed into the registers within U3. This binary data is provided by the data acquisition and interrogation block 20 and is present on the time period bus. The registers within the counter item 36 are preset with the period of controlled appliance data, set up by the authorised collection staff commander unit connected to the data input socket upon receiving the validation signal from the data acquisition and interrogation block, which changes state when valid data from the commander units security code matches that which is programmed into the unit itself during manufacture.

The purpose of "N" could also be considered to represent the number of multiples of the divided down master clock signal from the timing block 25. These divided down multiples are added together to form the total period of controlled appliance use. The total period of use of the monitored apparatus is normally the accounting frequency used by the collection staff.

Gates U6A and U4B act to provide an output signal when (N - 1) pulses have been received by gate 36. The output from gate U4B is fed via a NPN transistor Q6 the base of which is supplied via resistor R13 from the output of the

master oscillator 40 in the form of the 0.1 Hz square wave. Assuming that the oscillator 40 is still operating, therefore, the signal from the output of gate U4B passes via resistor R5 and diode D6 to control a warning circuit  
5 generally indicated 45 comprising two transistors Q2, Q4. The collector of Q2 is connected to the cathode of LED1, whilst the collector of Q4 is connected to the emitter of Q2. The base of Q2 is connected to the cathode of D6 which is, via R5, connected to the emitter of Q6. Q6 is  
10 used to gate the "lperiodleft" signal from NOR gate U4:B at time periods equal to half of the periodic time of the master clock waveform, therefore Q2's collector current (and therefore current and resultant light output from LED1) is controlled by the gated "lperiodleft" signal  
15 from Q6. Q2's collector current must pass the chassis via the collector-emitter junction of Q4. Q4's base is connected in parallel with Q5's base-emitter junction, which is part of the circuit used to drive the power switching transistor Q1. The circuit formed is biased  
20 from the +3.8v rail by the current limiting resistor R12. Q4, Q5, D6 and D9's purpose is to reduce current demands on the +BACKUP supply to a bare minimum by preventing current flowing from or to the logic gates U6:B and U4:B whenever the supply derived from the controlled appliance  
25 (present on terminal 13) ceases, (when the appliance is unplugged from the mains for example). The action of

this circuit is controlled by the state of the +3.8v rail. With this circuit feature, the current drawn from the +BACKUP rail is under 100 $\mu$ A - allowing the circuit to be correctly powered for long periods of time without  
5 requiring the monitored apparatus to be operating. Because BAT1, the source of the +BACKUP supply is recharged whilst the supply from the monitored apparatus is present, any shortfall in the +BACKUP source is quickly made good.

10

The current limiting resistor R12 is connected to the base of a transistor Q5 the collector of which is connected to the emitter of transistor Q3 the base of which is biased via resistor R10 from the output of gate  
15 U6B. Resistor R12 provides base bias for the circuit from the +3.8v rail. The second input of gate U6B is supplied on line 46 from the validation output of the decoder 20. When the power switch constituted by transistor Q1 is conductive, that is when the monitored  
20 apparatus is within its activation time, the base bias of transistor Q1 flows through the resistor R11 and diode D9 through the series-connected collector-emitter junctions of transistors Q3 and Q5 of the chassis. Currents cannot flow through the gate U6:B because of transistor Q5,  
25 diode D9 and the high value resistor R10. Therefore the load on the +BACKUP supply rail is reduced when the mains

supply is removed from the monitored apparatus and the 3.8v rail collapses switching the transistors Q5 and Q4 off.

5 When the warning lamp LED1 is illuminated the user is advised that the last unit of the time period (in this case one week) has commenced, thereby giving adequate warning that action must be taken in order to reset the equipment. By contacting the hire company the user can  
10 request that the hirer's representative call and, assuming all is well, the data validating the operation of the circuit for a further determined time period can be input by applying the appropriate signals to data input 19. If the decoder 20 does not respond  
15 appropriately to the validation interrogation the company representative can take the appropriate action whilst on the premises to remove the equipment for "examination". Since this occurs at the interchange between a time period which has been paid for and a fresh time period  
20 which would be paid for if the equipment was in order, the customer has no ground for complaint and the company recovers its equipment.

Whilst the authorised collection staff are present at the  
25 installed monitored apparatus, the monitoring unit can verify its condition to collection staff in two distinct

ways. Due to the action of NOR gate U6:B, the output enabling signal present on the base of the Q1 (power switching) driver transistor Q3 changes state whenever a validation signal from the data acquisition and  
5 interrogation block is present. Because of this, whenever valid data from the authorised collection staff's commander unit is received, the monitored apparatus enters its controlled, shutdown state for a brief period during data transfer. This will confirm to  
10 the collection staff present that the monitoring unit is providing the necessary control over the appliance. Should a skilled customer surreptitiously attempt to defeat the action of the monitoring unit by by-passing the power switching sections, or even removing the  
15 monitoring unit altogether the monitored apparatus will not power down during data transfer. This will indicate to staff that a problem exists, and appropriate procedures can take place.

20 Another way in which the monitoring unit might be defeated by skilled persons would be to stop the master oscillator waveform from changing state. However, to counter this the authorised collection staff could, whilst in the customer's premises, briefly program the  
25 monitoring unit with the time period, via the commander unit and data input socket of "1 time period remaining"

- on this the monitored apparatus' credit warning indicator should start, working at a regular frequency dictated by the master clock waveform. If it does not the customer's activities will again be exposed. If all is well the authorised collection staff could then program the monitoring unit with the correct time period data via the commander unit, as before. As previously stated, the monitoring unit cannot be damaged by direct connection to the mains voltage at its data input socket, due to the action of the over voltage protection circuit. Should the customer attempt to extend the rental timing period by disconnecting the controlled appliance from its power source the arrears controllers internal timing and digital processing block continues to function, maintaining the passage of time. Should a way be found to mimic the period setting data from the authorised collection staffs' commander unit, each individual monitoring unit, as mentioned above, has its own unique security code, preset during manufacture which cannot be externally changed. Before the authorised collection staff commander unit can be used to specify the required rental time period, the particular monitored apparatus security code must also be entered. Should this security code be found to differ from the monitoring units own code the new data is ignored and the time settings remain unchanged. The data acquisition and interrogation block

carries out this function.

It will be appreciated that the monitoring equipment of the present invention provides for operation in even the  
5 most difficult circumstances since, except for those sufficiently skilled to open the television cabinet, locate the power switch and solder a bypass connection, users must request attendance at their premises of a company representative in order to validate the equipment  
10 for a fresh period of use. Moreover, because the time interval set for the equipment is known, a company will in any event know that the customer is scheduled to make contact within a relatively narrow time span and if the customer fails to make contact during that time span  
15 appropriate remedial action can be instituted immediately.

In other embodiments, now shown, the data input terminal  
19 may be replaced by a remote communications unit  
20 allowing the authorised representative to monitor the equipment from a central base station and renew the time period for example when visited by the customer.

## **INTRODUCTION & CLAIMS**

### **Collection Staff Arrears Controller**

The rental market, whatever the type of product may be involved, is known for the risk the equipment owner runs in failing to collect rental charges, or indeed to recover his goods in Contract Termination situations.

The Collection Staff Arrears Controller meets these problems by:-

- 1) No coins to be stolen or re-cycled.
- 2) The Device is built into the host appliance - cannot be by-passed
- 3) The Device forms part of the host appliances' circuit - if the host appliance is stolen and the Device removed the appliance will be virtually useless.
- 4) Variable rental periods can be programmed to respond to customers needs.
- 5) Administrative customer identity numbers prevents illegal use if a command unit is stolen or lost.
- 6) Warning is given of loss of Customer credit in time for action to be taken.
- 7) Attempts to disable the Device by the injection of high voltage will not harm the controlling properties of the Device.
- 8) The Device is unaffected by the unplugging of the host appliance from the mains or other electricity supply, and will continue to function, shutting the appliance down at the pre-programmed time whether the appliance is plugged into its supply or not.
- 9) The Collection staff are given a clear indication on the command unit of any defect in the Device such as open or short circuits together with a "Correct Operation" indication.



**Revised Areas of Originally Claimed.**

**Collection Staff's Arrears Controller**

- 1) This invention is as described in the accompanying Specification. It is an electronic device designed to control rental customer arrears by providing restricted lengths of equipment use which can be electronically programmed by rental revenue collection staff from outside of the equipment by the Collection Staff's Arrears Commander. The Arrears Controller differs from previous designs by the use of a "Data Input Socket" where a direct electrical connection is made between the Arrears Controller and the Collection Staff's Commander unit. This direct electrical connection is achieved because the Collection Staff's Commander unit is fitted with a suitable plug which mates with a suitable "Data Input Socket" fitted to the Arrears Controller. Unlike other designs, no method of "remote access" or other transmitted information means over the air (Radio) or Light (infrared data pulses) is used as part of the Arrears Controller.
- 2) The input circuitry dealing with voltages and electronic data from the "Data Input Socket" features protection means within the "DATA ACQUISITION AND INTERROGATION" circuit block that protects the Arrears Controller against damage or incorrect and or spurious operation if incompatible or destructive voltages are applied to the "Data Input Socket".
- 3) No Smart or Credit cards or coin collection or mechanical key linkages or interlocks means are used by the Arrears Controller.



Application No: GB 9816378.5  
Claims searched: 1-9

Examiner: Dave McMunn  
Date of search: 10 November 1999

**Patents Act 1977**  
**Search Report under Section 17**

**Databases searched:**

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.Q): G3T (TS2).

Int Cl (Ed.6): G07F 7/00, 17/28.

Other: ONLINE : WPI, EPODOC, JAPIO.

**Documents considered to be relevant:**

Category	Identity of document and relevant passage	Relevant to claims
X	EP 0,371,451 A2 (SECURE-TIME). See whole spec.	1-9
X	EP 0,221,533 A2 (MATSUSHITA). See whole spec.	1-9
X	WO 87/03389 A1 (GREEN). See e.g. lines 9-25, page 3	1-9

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.

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